
भवनों के रखरखाव की व्यवस्था—
मार्गदर्शी सिद्धांत

भाग 1 सामान्य

(पहला पुनरीक्षण)

**Maintenance Management of
Buildings — Guidelines**

Part 1 General

(*First Revision*)

ICS 91.040.01

© BIS 2018



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

FOREWORD

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

Maintenance management in building industry is the art of preserving over a long period what has been constructed. It is as important as construction management or even more. Whereas construction stage lasts for a short period of 2 to 5 years, maintenance continues for at least 20 to 30 times the construction phase. Bad practice of maintenance adversely affects the environment in which people work, thus affecting the overall output.

Even though the adverse effects of deterioration of a building are known, yet the process of maintenance of the building is given a very low priority and most of maintenance decisions are taken by the management on the basis of expediency, and in most of the cases are unrelated compromises between the physical needs and availability of finance.

Though the buildings may be designed to be very durable, they need maintenance to keep them in good condition. Everyone concerned with buildings whether as owners, engineers, designers, constructors or users should take a serious interest in building maintenance. In the post-construction stage, the day-to-day maintenance or upkeep of the building shall certainly delay the decay of the building structure.

The Indian Standard IS 15183 was envisaged to address the important aspect of maintenance management of buildings. This standard is published in three parts. The others parts in the series are:

Part 2 Finance

Part 3 Labour

This standard (Part 1) was first published in 2002 and was intended to cover the general aspects related to maintenance management of building fabric including the electrical and mechanical services. This standard keeps in view the practices in the field of building maintenance management in the country.

The first revision of the standard is aimed at bringing the provisions at par with the provisions of the SP 7 (Part 12) : 2016 'National building code of India 2016: Part 12 Asset and facility management'. Also, other necessary changes have been incorporated.

In this revision the following major changes have been made:

- a) New provisions on maintenance methods covering planned and unplanned maintenance have been included in detail;
- b) Factors affecting building maintenance have been elaborated in detail;
- c) Provisions on influence of design on building maintenance have been elaborated in detail;
- d) Maintenance policy has been detailed with emphasis on size and type of building;
- e) Provisions on performance management and information management have been included; and
- f) Terminologies have been updated.

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

*Indian Standard***MAINTENANCE MANAGEMENT OF
BUILDINGS — GUIDELINES****PART 1 GENERAL***(First Revision)***1 SCOPE**

This standard (Part 1) provides general guidelines for maintenance management of building fabric including building services (electrical and mechanical).

NOTE — For detailed provisions on management of building assets and associated facilities; and maintenance of fixed assets and building services facilities, a reference may be made to the SP 7 (Part 12) : 2016 'National building code of India 2016: Part 12 Asset and facility management'. Also, the sustainability aspects related to maintenance given in 13.3 of SP 7 (Part 11) may be referred.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
15183	Guidelines for maintenance management of buildings
(Part 2) : 2018	Finance (<i>first revision</i>)
(Part 3) : 2018	Labour (<i>first revision</i>)
15883	Guidelines for construction project management: Part 1 General
(Part 1) : 2009	
SP 7 : 2016	National building code of India 2016

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Access — Approach, entry, internal circulation or exit, including in cases of emergency.

3.2 Ageing — Getting old, specifically beyond the design life of the asset.

3.3 As-built Information — Expression of the design, its working detail, construction works and/or

installations, functions, operations and maintenance needs of a facility in a form suitable for use in managing that facility.

3.4 Asset — A useful or valuable thing or an item of property owned by a person or organization, regarded as having value and life of more than one year, available to meet debts, commitments, or legacies and performing predetermined functions to facilitate the users.

3.5 Asset Life — Period from asset creation to end of its functional life.

3.6 Asset Register — A central database of information about asset/facility in terms of their manufacturer, vendor, make, model, specifications, date of acquisition, initial cost, maintenance costs and requirements, additions/alterations over period, accumulated depreciation and written down value.

3.7 Asset Type — Grouping of assets having common characteristics that distinguish those assets as a group or class, for example, physical assets, information assets, intangible assets, critical assets, enabling assets, linear assets, information and communications technology (ICT) assets and infrastructure assets.

3.8 Asset/Facility Management — Integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities.

3.9 Benchmarking — Comparing performance, often between companies in similar sectors.

3.10 Biodegradable Waste — Any organic material that can be degraded by microorganisms into simpler stable compounds.

3.11 Briefing — Briefing is the process of communicating the objectives and needs of an owner, or prospective owner, of a facility to a designer in order to prepare a design for that facility. This process includes not only clarification and confirmation of the owner's intentions and documenting the consequent provisions for the facility to enable informed decision making primarily in design, but also in construction work and/or installation, testing and commissioning, handover and start-up

of operations. A number of stages are envisaged for preparing and applying the brief during design and in later phases.

3.12 Buffer Zone — A zone of no development which shall be maintained around landfills, processing and disposal facilities of solid waste.

3.13 Building Fabric — Elements and components of a building other than furniture and services installations.

3.14 Building Information Model (BIM) — Shared digital representation of physical and functional characteristics of any built object (including buildings, bridges, roads, etc) which forms a reliable basis for decisions.

NOTE — A building information model may embody, for example, building geometry, spatial relationships, geographic information and the quantities and properties of building components.

3.15 Building Maintenance — Work undertaken to maintain or restore the performance of the building fabric and its services to provide an efficient, safe and acceptable operating environment to its users.

3.16 Building Management System (BMS) — Computer aided control systems, including hardware and software, to collect and monitor parameters and performance data of plant, equipment, systems and elements either at source or remotely and to enable corrective action to be initiated.

3.17 Building Manual — Guidance to assist in making the best use of the design features, services and systems of a building or other facility.

3.18 Business Continuity Management (BCM) — Holistic management process that identifies potential threats to an organization and the impacts to business operations that those threats, if realized, may cause, and which provides a framework for building organizational resilience with the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand and value creating activities.

3.19 Carbon Emissions — Polluting carbon substances released into the atmosphere.

3.20 Carbon Footprint — Totality of greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product.

3.21 Cleaning — Locating, identifying and properly disposing of undesirable substances from surfaces or material.

3.22 Cleaning Services — Services undertaken to ensure the cleanliness, maintenance and aesthetic upkeep of the building/property.

3.23 Competent Person — Person, suitably trained and qualified by knowledge and practical experience.

3.24 Computer Aided Facilities Management (CAFM) — Systems, applications and tools that automate functions needed to support the core business in its efficient and effective use of facilities.

3.25 Computer Aided Maintenance Management System (CMMS) — System specifically designed to enable planning, organizing, directing and controlling maintenance programmes and to collect and collate historical data on the performance of assets so that the most effective maintenance method is selected under actual performance and environmental conditions.

3.26 Condition Monitoring — Act of measuring and recording data from operating parameters, using either human senses or instrumentation, to verify plant and equipment condition and trends. It is also the act of assessing an asset to understand how it is likely to perform in future.

3.27 Confined Space — Space which may be inadequately ventilated for any reason and may result in a deficiency of oxygen, or a build-up of toxic gases, for example, closed tanks, sewers, ducts, closed and unventilated rooms, and tanks particularly where heavier than air gases or vapours may be present.

3.28 Corrective Maintenance — Maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function.

3.29 Crime Prevention Through Environmental Design (CPTED) — A multi-disciplinary approach to deterring criminal behaviour through environmental design. CPTED strategies rely upon the ability to influence offender decisions that precede criminal acts. CPTED principles of design affect elements of the built environment ranging from the small-scale (such as the strategic use of shrubbery and other vegetation) to the overarching, including building form of an entire urban neighbourhood and the amount of opportunity for “eyes on the street”.

3.30 Critical Activities — Activities which have to be performed in order to deliver the key products and services which enable an organization to meet its most important and time sensitive objectives.

3.31 Critical Asset — Asset having potential to significantly impact on the achievement of the organization’s objectives.

3.32 De-construction — A planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized.

3.33 Deliverable — Product or service as an outcome of a process.

3.34 Design Development — Transitional phase where the basis of the design progresses towards the production of detailed design information.

3.35 Design Life (DL) — Intended/expected service life by the designer or as stated by the designer to the client to support specification decisions.

3.36 Documented Information — Information required to be controlled and maintained by an organization and the medium on which it is contained.

3.37 Domestic Hazardous Waste — Waste contaminated with hazardous chemicals or infectious waste such as discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles, gauge and syringes, etc, generated at the household level.

3.38 Dry Waste — Waste, other than food waste, inert and including recyclable waste, non recyclable waste, combustible waste and sanitary waste.

3.39 Dump Sites — A land utilized by urban local body for unscientific disposal of solid waste without following the principles of sanitary land filling.

3.40 Durability — Ability of a building and its parts to perform its required function over a period of time and under the influence of agents.

3.41 Duress Alarms — Duress alarms are installed to protect personnel who may be placed in danger of physical assault during interactions with other persons. Duress alarms are normally placed in locations where a resident/employee may be alone with a potentially threatening person.

3.42 End-user — Recipient of facility-related services.

NOTE — Recipients include occupants and other users of a facility.

3.43 Estimated Service Life (ESL) — Service life that a building or parts of a building should be expected to have in a set of specific in use conditions, determined from the reference service life data after taking into account any differences from the reference in-use conditions.

3.44 Exterior Property — The open space on the premises under the control of owners or operators of such premises.

3.45 External Envelope — Roof and façade including openings.

3.46 Facilities Maintenance — Work needed to maintain the performance of the building structure, fabric and components, and engineering installations.

3.47 Facility — Tangible asset that supports/serves an organization.

3.48 Facility Asset Performance — Requirements in terms of measurable outcomes for meeting organizational goals.

3.49 Hazardous Waste — Waste that possesses the properties of a hazardous material (for example ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment, if improperly managed. Wastes may also be defined as ‘hazardous’ by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics. Sludge from a waste treatment plant, water supply treatment also can form a part of hazardous waste.

3.50 House Keeping — The routine recurring work which is required to keep a structure in good condition so that it can be utilized at its original capacity and efficiency along with proper protection of capital investment, throughout its economic life.

3.51 Information Management — Processing and storage of information in a controlled manner.

3.52 Intrusion Detection Systems — An intrusion detection system (IDS) is a device or software application that monitors the activities for malicious activities or policy violations and produces reports to a management station. Intrusion detection and prevention systems (IDPS) are primarily focused on identifying possible incidents, logging information about them, and reporting attempts.

3.53 Life Cycle — The stages of an asset from acquisition through commissioning and operation to disposal.

3.54 Maintenance — An intervention on an asset to improve its operation or ensure its continued good operation (It is also the combination of all technical and associated administrative actions during the service life to retain a building, or its parts, in a state in which it can perform its required functions.).

3.55 Maintenance Management — Process of ensuring that the most effective and efficient maintenance programme is formulated and delivered to ensure that assets/facilities continue to perform their intended function. The organization of maintenance has to be within an agreed policy. Maintenance can be seen as a form of ‘steady state’ activity.

3.56 Maintenance Manual — Technical instructions intended to preserve an asset/facility in, or, restore it to a state in which it can perform a required function.

3.57 Maintenance Plan — Structured and documented set of tasks that include the activities, procedures, resources and the time scale required to carry out maintenance.

3.58 Maintenance Policy — Scope and course of action taken to achieve an organization's objectives.

3.59 Maintenance Programme — Arrangement of maintenance tasks in terms of their sequence, durations and resource requirements.

3.60 Maintenance Strategy — Statement of organizational approach to maintenance management.

3.61 Management System — Set of interrelated or interacting elements of an organization to establish policies and objectives and processes to achieve those objectives.

3.62 Mantrap — A small room with two doors. The first door is locked; a person is identified and authenticated. Once the person is authenticated and access is authorized, the first door opens and allows the person into the mantrap. The person has to be authenticated again in order to open the second door and access a critical area. The mantrap area can have a weight sensing floor as an additional control to prevent literal piggybacking.

3.63 Occupants — Users who spend a significant proportion of their time in or about a facility.

3.64 Operational Plan — Organization's statement of actions intended to achieve a specific business goal(s).

3.65 Operational Strategy — Overall approach to manage production or use of a facility.

3.66 Owner — Person or body having a legal interest in a building. This includes free holders, lease holders or those holding a sub-lease which both bestows a legal right to occupation and gives rise to liabilities in respect of safety or building condition. In case of lease or sub-lease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allottee/lessee till the allotment/lease subsists.

3.67 Perimeter Intrusion Detection and Assessment System (PIDAS) — A type of fencing that has sensors on the wire mesh and base of the fence. A passive cable vibration sensor sets off an alarm if an intrusion is detected.

3.68 Perimeter Security — Control and observation of areas of ingress and egress to a building and parking structure, including main lobby doors, rear plaza doors, truck docks, fire exits, and other points of access.

3.69 Physical Asset — A tangible, manmade object that has a specific function, normally within a broader system.

3.70 Planned Preventive Maintenance — Maintenance organized and carried out with forethought, control and the use of records to a plan based on the results of condition surveys.

3.71 Predicted Service Life — Service life predicted from performance recorded over time in accordance with standard laid down procedure.

3.72 Predictive Action — Action to monitor the condition of an asset and predict the need for preventive action or corrective action.

3.73 Preventive Maintenance — An intervention on an asset taken in advance of a failure to reduce the chances of failure.

3.74 Preventive Action — Action to eliminate the cause of a potential non-conformity or other undesirable potential situation (for asset/facility management).

3.75 Primary Collection — Collecting, lifting and removal of segregated solid waste from source of its generation including households, shops, offices and any other non-residential premises or from any collection points or any other location specified by the urban local body.

3.76 RASCI Chart — Responsible, accountable, supported, consulted and informed (RASCI) chart that is used to summarize the roles and functions performed in the procurement process and the activities within it.

3.77 Reliability Centered Maintenance (RCM) — An approach which targets intervention on assets based on the known historic performance of that or similar assets.

3.78 Repair, Renovate, Refurbish — An intervention which improves the performance and condition of an asset to upgrade or retain desired performance.

3.79 Residual Waste — Includes the waste and rejects from the solid waste processing facilities which are not suitable for recycling or further processing.

3.80 Root Cause Analysis — A thorough assessment of all of the factors influencing the occurrence of a fault or failure.

3.81 Sanitary Land Filling — The final and safe disposal of residual solid waste and inert wastes on land in a facility designed with protective measures against pollution of ground water, surface water and fugitive air dust, wind-blown litter, bad odour, fire hazard, animal menace, bird menace, pests or rodents, greenhouse gas emissions, persistent organic pollutants, slope instability and erosion.

3.82 Sanitary Waste — Wastes comprising of used diapers, sanitary towels or napkins, tampons, condoms, incontinence sheets and any other similar waste.

3.83 Scope Creep — Uncontrolled changes to the agreed scope of the facility related service being provided.

3.84 Secondary Collection — Collection of solid waste deposited at secondary waste storage depots or bins for onward transportation of the waste to the processing or disposal facility.

3.85 Secondary Storage — The temporary containment of solid waste at a public place in a covered bin or container in a manner so as to prevent littering, vectors, stray animals and odour.

3.86 Service Life — Period of time after installation during which a building or its parts meets or exceeds the performance requirements.

3.87 Shutdown/Outage — A period, either planned or otherwise, during which asset interventions occur and is not available for its use.

3.88 Stabilizing — The biological decomposition of biodegradable wastes to a stable state where it generates no leachate or offensive odours and is fit for application to farm land, soil erosion control and soil remediation.

3.89 Stakeholder — Individual, organization or group with an interest in an organization, facility or project. It also applies to the person or entity with an interest in or concern about a facility.

3.90 Surveillance — Surveillance is the monitoring of the behaviour, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. This can include observation from a distance by means of electronic equipment (such as, CCTV cameras). Surveillance is used for intelligence gathering, the prevention of crime, the protection of a process, person, group or object, or for the investigation of crime. Surveillance is often a violation of privacy, and is opposed by various civil liberties groups and activists.

3.91 Surveillance Devices — Surveillance device can be defined as any instrument, apparatus or equipment used either alone, or in conjunction with other equipment, which is being used to conduct surveillance.

3.92 Whole Life Costing — An understanding of the full economic impact of owning an asset, covering all stages of its life cycle.

4 BUILDING MAINTENANCE — METHODS AND MANAGEMENT

4.1 General

Any building (including its services) when built has certain objectives and during its total economic life, it has to be maintained in proper condition to meet those objectives. Maintenance is a continuous process

requiring a close watch and taking immediate remedial action if some of its units are found under performing. It is interwoven with good quality of housekeeping. It is largely governed by the quality of original construction. The owners, engineers, constructors, occupants and the maintenance agency are all deeply involved in this process and share a responsibility. Situation in which all these agencies merge into one is ideal and most satisfactory.

There are two processes envisaged, that is, the work carried out in anticipation of failure and the work carried out after failure. The former is usually referred to as preventive maintenance and the latter as corrective maintenance. The prime objective of maintenance is to maintain the performance of the building fabric and its services to provide an efficient and acceptable operating environment to its users.

Maintaining a building is expensive; it costs many times more to run a building over its lifetime than to build it, yet maintenance is often not accorded the priority it warrants. A poorly maintained building will be a drain on resources and will impair building use, whereas a well maintained building will function smoothly and represent an appreciating asset to its owners. A professional approach is therefore required to building maintenance.

Though the building may be designed to be very durable it needs maintenance to keep it in good condition. Whereas construction stage lasts for a short period, maintenance continues for comparatively very large period during the functional life of building. Inadequate or improper maintenance adversely affects the environment in which people work, thus affecting the overall output. In the post construction stage, the day to day maintenance or upkeep of the building shall certainly delay the decay of the building structure. Maintenance management of building is the art of preserving over a long period what has been constructed. A reference may also be made to the provisions on construction project management including maintenance as given in IS 15883 (Part 1).

4.1.1 The objectives of maintenance are:

- a) To preserve building and its services, machinery in good operating condition;
- b) To restore it back to its original standards; and
- c) To improve the facilities depending upon the development that is taking place in building and services engineering.

4.1.2 Maintenance, in general term, can be identified in the following broad categories:

- a) *Cleaning and servicing* — This is largely of preventive type, such as checking the efficacy of rain water gutters and servicing the mechanical and electrical installations. This covers the house keeping also.

- b) *Rectification and repairs* — This is also called periodical maintenance work undertaken by, say, annual contracts and including external replastering, internal finishing, etc.
- c) *Replacements* — This covers major repair or restoration such as retrofitting or re-building defective building parts.

4.2 Maintenance Methods

An organization should determine which method or combination of methods best satisfies its operational needs in maintenance in accordance with its facilities maintenance strategy and policy. Each method should be assessed in terms of the extent to which it satisfies (or does not satisfy) the criteria defined as part of the facilities maintenance strategy. When taking into account asset criticality and monitoring capacity within the facility, the benefit of combining methods should be evaluated.

There are a number of methods of maintenance; these can be grouped into following two broad categories (see Fig. 1):

- a) Planned maintenance, which includes planned preventive maintenance and shutdown maintenance. Preventive maintenance further includes condition-based maintenance, reliability centred maintenance (RCM) and total productive maintenance (TPM); and
- b) Unplanned maintenance, which includes corrective maintenance, breakdown maintenance and emergency maintenance.

4.2.1 Planned Maintenance

4.2.1.1 Planned preventive maintenance or scheduled maintenance

This method allows maintenance activities to be organized and carried out with forethought, control and records to a predetermined plan, based on the results of condition surveys. This method aims to avoid or to mitigate the ‘consequences of failure’ and to minimize maintenance-induced failures and their associated costs. It is based on the criticality of failure to the organization and is also known as scheduled maintenance.

Planned preventive maintenance is further classified into following categories:

- a) *Condition-based maintenance* — This method of maintenance is based on the results of condition monitoring of building, plant, equipment, systems and elements to avoid loss of function or failure. Condition-based maintenance is performed by selecting and monitoring a parameter which, for example, indicates plant condition. Data are collected and analyzed and required maintenance is determined from the findings. This work can be carried out continuously, periodically or on demand in real time and is often used for remotely monitoring plant condition.
- b) *Reliability centred maintenance* — Reliability centred maintenance is a systems-based method used to determine maintenance tasks needed to ensure that a facility, asset or system continues to function in order to fulfil its purpose as designed in its present operating condition. The method can involve the implementation of asset condition monitoring, based on the advance provision of an asset register.
- c) *Total productive maintenance* — Total productive maintenance is a systematic approach to improving maintenance effectiveness, which operates at the tactical level and normally builds on the successful implementation of strategic methods.

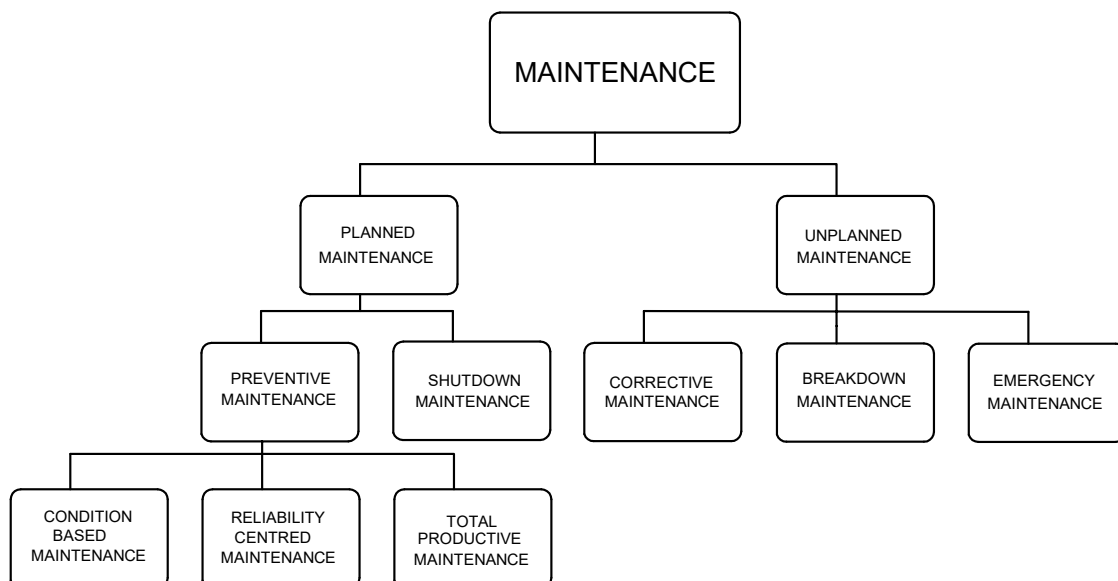


FIG. 1 MAINTENANCE METHODS

The method also involves the implementation of asset condition monitoring, based on the advance provision of an asset register.

4.2.1.2 *Planned shutdown maintenance*

This method is normally used for continuous process production and manufacturing facilities, where a detailed plan is prepared for all assets for work to be carried out during a total shutdown.

4.2.2 *Unplanned Maintenance*

4.2.2.1 *Corrective maintenance*

Maintenance initiated as a result of the observed or measured condition of plant, equipment, systems, elements, before or after a functional failure, can be used to resolve the problem and ensure correct functional performance. This work can be planned or unplanned.

4.2.2.2 *Breakdown maintenance*

Breakdown maintenance relates to the task of restoring an asset so that it can fulfill its original function after failure. This method may result in high replacement costs over the lifetime of the asset, but has a low initial maintenance resource requirement. It is sometimes used for simple facilities that have few operatives and no critical environment to support.

4.2.2.3 *Emergency maintenance*

This maintenance method results from a sudden, unforeseen occurrence requiring immediate corrective work to be carried out to restore to function and to avoid potentially serious consequences.

4.3 **Aspects Influencing Building Maintenance**

4.3.1 Maintenance of the buildings is influenced by the following factors:

- a) *Technical factors* — These include age of building, nature of design, material specifications, past standard of maintenance and cost of postponing maintenance.
- b) *Maintenance policy* — A maintenance policy ensures that value for money expended is obtained in addition to protecting both the asset value and the resource value of the buildings concerned and owners.

A maintenance policy should be developed to support the preparation of operational plans in accordance with the maintenance strategy. The policy should outline the scope and course(s) of action that should be taken to achieve an organization's goals. The maintenance policy should embody the principle of best value for money to protect both the asset value and the resource value of the facility. The policy should cover:

- 1) The organization's anticipated future requirements for the facility, taking into account the facility's physical performance and functional suitability, for example:
 - i) the use of the facility, that is, anticipating likely upgrades and the effect on the life cycles of existing materials, components and engineering installations;
 - ii) a change of use for the facility and the effect of any conversion work on the life cycles of existing materials, components and engineering installations; and
 - iii) the anticipated date of conversion, renovation or refurbishment work.
 - 2) Any cycles of maintenance determined in accordance with (1);
 - 3) The method of maintenance, taking account of cycles of maintenance together with the requirements of the organization with respect to the use of the facility and any special requirement to which this may give rise;
 - 4) Holding spare parts and other items to replace those that are beyond repair or which have exceeded their useful life; and
 - 5) The means for reporting on performance achieved.
- c) *Financial and economic factors* — See 4 of IS 15183 (Part 2).
- d) *User* — The maintenance requirements of buildings and their various parts are directly related to the type and intensity of use they receive and the people who use these facilities especially those with disabilities, elderly and children in particular.

4.3.2 *Other Factors Affecting Maintenance*

4.3.2.1 *Health and safety*

4.3.2.1.1 *General*

The management of occupational health and safety has to be viewed as an integral component of facilities maintenance management and not as a separate function or as an add-on.

An organization should assess risks and other hazards at all stages in a facility's life cycle. Identified risks should be monitored and, wherever possible, their potential impacts should be mitigated. An organization should implement a formal system of risk management, including establishing and maintaining a risk register. Periodic reassessment of risks should be undertaken to update the risk register and associated risk mitigation.

4.3.2.1.2 *Initial review*

An initial review should be undertaken to provide information on the appropriateness, efficiency and

effectiveness of existing health and safety management systems. Where no formal, or a minimal, health and safety management system exists (such as when an organization is newly established or when carrying out new activities) the initial review should be used as a base from which to develop a new system.

4.3.2.1.3 Risk control and corrective actions

An organization should implement risk control, as an integral part of its risk management, to ensure that control measures remain in place and that they remain efficient and effective. The risk management system should allow, as a minimum, for the following:

- a) Identification of health and safety hazards arising from maintenance and other work determined by workplace inspections, behavioural observations, tours, and formal and informal discussions with the workforce;
- b) Identification of people who may be at risk from maintenance, for example, maintenance personnel, occupants, visitors, passers-by, trespassers, persons with disabilities, elderly people and children;
- c) Evaluation of the risks to which individuals and/or an organization may be exposed;
- d) Devising ways to eliminate, reduce and/or control risks, for example guarding and fencing, method statements, safe systems of work, standard operating practices (SOPs), permit-to-work, training and supervision;
- e) Monitoring and recording the effectiveness of risk control measures and systems, for example inspections, observations, safety tours and checklists;
- f) Taking coordinated corrective action;
- g) Providing feedback to the workforce and other stakeholders;
- h) Training, together with health and safety checks, of operatives; and
- j) Auditing and reviewing the system and, therefore, health and safety performance.

The use of access equipment should be assessed to maximize the benefits of use and to optimize the overall cost of maintenance; which should take into account future requirements for access that might arise on multi-year programmes of maintenance. The longer term implications of providing access, particularly the equipment required for this purpose, should be evaluated and permanent means of access should be used where possible.

4.3.2.2 Environmental factors

4.3.2.2.1 External

An organization should assess the extent to which external environmental factors can influence the

condition of the structure, fabric, engineering installations, fixtures and external finishes, and take such factors into account when drawing up maintenance plans. This should also include control of moisture. For example, swimming pool structures are vulnerable to the effects of chlorine used in water.

4.3.2.2.2 Internal

Humidity, temperature and pollution are factors that can adversely affect the condition of the structure, fabric, engineering installations, fixtures and internal finishes. The effects of intermittent heating and condensation can be considered as an extra ordinary condition.

An organization should assess the extent to which internal environmental factors, as well as the level of maintenance, influences the condition of the structure, fabric, engineering installations, fixtures and internal finishes. These factors should be taken into account when maintenance plans are drawn up. Factors that have a damaging effect on physical conditions, for example control of moisture, static electricity, as well as any unintended consequences for maintenance personnel, occupants and other users of the facility, should also be taken into account.

4.3.2.3 Materials and components

When drawing up maintenance programmes and plans, including inspection schedules, the likely maintenance cycle of each element/sub-element (in accordance with the known quality of the materials and components employed and their manufacturers' recommendations where available) should be incorporated. The following need special attention:

- a) Potentially hazardous materials and components such as:
 - 1) those containing asbestos;
 - 2) lead, which may be present in some paint or be used for pipes carrying potable water;
 - 3) materials that are either highly combustible or give off large quantities of smoke and fumes when involved in an established fire or in confined spaces (for example electrical risers); and
 - 4) areas that should operate under a permit-to-work system.
- b) Types or methods of construction that, under certain circumstances, may become dangerous.
- c) Finishes and decorations, including their protection and treatment, where required.

4.4 Influence of Design

4.4.1 The physical characteristics, the life span and the aesthetic qualities of any building depend on the considerations given at the design stage. All buildings, however well designed and carefully built, will require repair and renewal as they get older. For better

performance of the building envelope, the following ways help to minimize troubles at later stage:

- a) Due attention be paid to maintenance requirements of the facility from the planning stage. The agency which is likely to be entrusted with the work of subsequent maintenance and upkeep of the facility should be involved from the design stage itself. Their inputs will be very valuable in ensuring economical maintenance during the lifetime of the facility. This aspect needs greater attention as the defects occurring at planning stage are difficult to be addressed at subsequent stages.
- b) Detail and choose materials during construction so that the job of maintenance is less difficult.
- c) Specifications adopted should be practical and based on local practices. Durability considerations and maintenance of various areas should be kept in view.
- d) In addition to initial costs and life, type of finish achieved and fire and life safety requirements should be built in at the time of design.
- e) Detailing of components should be done to ensure that they are conducive to effective operation and maintenance.
- f) Accessibility for maintenance purposes of areas and services requiring maintenance is taken care of. It is necessary that service personnel are able to reach the service easily, safely, have adequate working space, safe working conditions and adequate lighting provisions. Cleaning of façade and replacement of glass panes needs to be kept in view while finalizing exteriors.
- g) In addition to designing a building for structural adequacy, consideration should also be given to protect against adverse environmental factors such as moisture, natural weathering, corrosion and chemical action, wear and tear, pollution, flooding, subsidence, earthquake, cyclone, etc.
- h) Design phase should cover such items as the owner's anticipated future requirement for the building taking account of the building's physical performance and its functional suitability. This may lead to decisions regarding:
 - 1) A change of use for the building and the effect of any conversion work on the life cycle of existing components or engineering services; and
 - 2) Availability of replacements.
- j) The present use of the building anticipating any likely upgrading and their effect on the life cycles of existing components or engineering services.
- k) Due attention when altering the occupancy/ functionality of a building, for example from residential to business or institutional or otherwise.

4.4.2 During construction stage it should be ensured that suitable construction techniques are adopted, adequate quality control measures are taken, special attention is paid to services and testing of lines, effective supervision throughout and sound remedying of defects is ensured.

Need of good workmanship needs no emphasis. Proper detailing of elements and various fittings and fixtures will ensure good workmanship and quality work which in turn will not only give longer life to the facility but will ensure their long term functional service.

4.4.3 A list of common causes for maintenance problems is given in Annex A for guidance. However, no such list is likely to be entirely comprehensive.

4.5 Maintenance Planning

4.5.1 General

Maintenance plans should be driven by and support the intended outcomes stated in the facilities maintenance policy and strategy and should be fully aligned with them. Maintenance plans should be prepared in consultation with stakeholders, taking account of the following as a minimum:

- a) Organization's requirements for production and operational demands and constraints;
- b) Organization's financial circumstances; and
- c) Feedback data on maintenance outcomes, including associated costs. Multi-year programmes of maintenance should be put in place where appropriate, that is, for long-term planning, finance or other expediency. Programmes should state a review date for assessing progress and performance.

When formulating maintenance plans, alternate maintenance methods should be evaluated. The links between the selected maintenance method(s), maintenance performance, facility asset performance and service delivery should be established through metrics, such as, key performance indicators (KPIs), based on a practical and effective maintenance process.

4.5.2 Assessment of Maintenance Planning

An organization should assess the benefits of maintenance planning, basing the assessment on the following:

- a) Contribution to the organization's goals;
- b) Satisfaction of stakeholder interests;
- c) Effectiveness of the facility in supporting the organization's operational plans;
- d) Availability and reliability of the facility at minimal cost;
- e) Capital planning;
- f) Asset/facility management strategy;

- g) Protection of the value of facility assets;
- h) Provision of data on facility asset performance;
- j) Provision of data for maintenance benchmarking;
- k) Provision of data for continual process improvement;
- m) Provision of data on environmental performance;
- n) Basis for service life planning;
- p) Contribution to energy management;
- q) Contribution to business continuity management;
- r) Basis for service level agreements;
- s) Transparency and sound governance in financial reporting;
- t) Identified security risks;
- u) Awareness towards environmental sustainability;
- v) Improvement of outsourcing and collaboration agreements;
- w) Contribution to the facilities management strategy;
- y) Contribution to total quality management; and
- z) Contribution to procurement and supply chain management.

4.5.3 Maintenance Planning Process

While taking up maintenance planning, following should be considered:

- a) Facility assets required to support the core business and the delivery of services should be defined;
- b) Required level of facility asset performance, including performance indicators, should be agreed;
- c) Condition and sufficiency of facility assets for their intended purpose should be audited;
- d) Scope of the maintenance required should be identified through gap analysis;
- e) An appropriate maintenance method from those available should be selected;
- f) Resources required for the chosen maintenance method should be assessed;
- g) Maintenance plans and budgets should be prepared to cover the required scope of services over the short, medium and long term;
- h) A tactical plan for delivery of maintenance should be formulated;
- j) Resources to deliver the scope of maintenance should be provided;
- k) Maintenance plans and programmes of work are implementable; and
- m) Performance monitoring, review and control of maintenance plans and programmes of work should be carried out.

Information and data gathered from this process should be used to re-inform the organization's need for, and use

of, facility assets during this and any future iterations, of this process.

4.5.4 Financial Management

The provisions given in 5 of IS 15183 (Part 2) shall be applicable.

4.6 Maintenance Work Programmes

The programming of maintenance work can affect an owner or his activities. Following aspects needs to be considered:

- a) Maintenance work should be carried out at such times as are likely to minimize any adverse effect on output or function.
- b) Programme should be planned to obviate as far as possible any abortive work. This may arise, if upgrading or conversion work is carried out after maintenance work has been completed or if work such as rewiring is carried out after redecoration.
- c) Any delay in rectifying a defect should be kept to a minimum only if such delay is likely to affect output or function. The cost of maintenance increases with shortening response times.
- d) Maintenance work, completed or being carried out should comply with all statutory and other legal requirements.

4.6.1 Maintenance Guides

An owner responsible for a large number of buildings may have established procedures for maintenance. When an owner is responsible for the maintenance of only one building or a small number of buildings, the preparation of a guide tailored to suit each particular building, can offer significant advantages. Such a guide should take into account the following:

- a) Type of construction and residual life of the building, and
- b) Environment and intensity of use.

The guide may form part of a wider manual covering operational matters.

4.6.2 Feedback

4.6.2.1 Feedback is normally regarded as an important tool for providing information about the behaviour of materials and detailing for the benefit of the architect/engineer designing new buildings, which will result in lessening maintenance costs. It is an equally valuable source of information for the persons responsible for maintenance. Every maintenance organization should develop a sample way of communicating its know-how, firstly for benefit of others in the organization and secondly for the benefit of the building industry as a whole. There should be frank and recorded dialogue on an on-going basis between those who occupy and care for buildings and those who design and construct them.

4.6.2.2 Feedback should aim at the following:

- a) User satisfaction, particularly from diversity of users, such as, women, elders and persons with disabilities;
- b) Continuous improvement; and
- c) Participation by all.

4.6.2.3 *Source of information*

The information on feedback can be obtained from the following:

- a) Occupants,
- b) Inspections,
- c) Records, and
- d) Discussions.

4.7 Means of Effecting Maintenance**4.7.1** *Responsibility*

Some maintenance work will be carried out by the occupier of a building or by the occupier's representative. In the case of leasehold or similar occupation not all maintenance may be the responsibility of occupier. Responsibility of common areas, as needed to be clearly defined (*see 5.6*).

4.7.2 The owner/occupant is primarily responsible for ensuring meeting minimum requirements of maintenance and upkeep as specified in **5.5**. Maintenance work sub-divided into major repair, restoration, periodical and routine or day-to-day operations may be undertaken by one of the following:

- a) Directly employed labour,
- b) Contractors, and
- c) Specialist contractors under service agreement or otherwise.

4.7.3 The merits of each category for typical maintenance work shall be considered because optimum use of resources appropriate to tasks in a given situation is an important element of policy.

4.7.4 The success of contracting out depends on the nature of the services, conditions in which contracting is undertaken (the tendering process), how the contract is formulated and subsequent monitoring of service quality. The important consideration in the decision to contract out is whether a contractor can ensure a socially desirable quantity and quality of service provision at, a reasonable cost to the consumers.

4.8 Access for Maintenance**4.8.1** *General*

All maintenance activities including any preliminary survey and inspection work require safe access and in some situations this will have to be specially designed. Maintenance policy, and maintenance costs, will

be much influenced by ready or difficult access to the building fabric and to building services. Special precautions and access provisions may also need to be taken for roof work or for entry into confined spaces such as ducts or voids.

4.8.2 *Access Facilities*

Permanent accessibility measures should be provided at the design stage only for all the areas for safe and proper maintenance. It is a matter on which those experienced in the case of the building can make an important contribution at design stage in the interest of acceptable maintenance costs.

A wide variety of temporary access equipment may appropriately be provided for maintenance work, ranging from ladders to scaffoldings or powered lift platforms.

Wherever possible, it is better to provide permanent access facilities, such as fixed barriers, ladders, and stairways. When such permanent access facilities are provided, necessary arrangement may be included in maintenance plans for their regular inspection, maintenance and testing.

All personnel employed for carrying out maintenance should be provided with the necessary protective clothing and equipment and instructed in its use.

When physical access is not possible in situations such as wall cavities, drains, etc, inspections may be made with the aid of closed circuit television or optical devices such as endoscopes.

4.8.3 *Access to Confined Spaces*

Following should be ensured for facilitating maintenance in confined spaces:

- a) *Ventilation* — Special precautions need to be taken when entering a confined space. Such confined spaces should be adequately ventilated, particularly before being entered, to ensure that they are free from harmful concentrations of gases, vapours, other airborne substances and that the air is not deficient in oxygen.
- b) *Lighting* — Good lighting is necessary in order that maintenance work can be carried out satisfactorily. This is particularly important in confined spaces. When the normal lighting is inadequate, it should be supplemented by temporary installations. These should provide general and spot illumination as appropriate.

5 PERFORMANCE MANAGEMENT**5.1** *General*

Performance management involves monitoring, controlling and improving the efficiency and effectiveness of maintenance management and applies to both internal and outsourced arrangements. Various

models, methods and tools are available to assist in the measurement of performance and in indicating where improvement is required; examples include, but are not limited to, value management.

Performance management can be used as a means to foster efficient and effective working relationships between the parties of a contract or agreement relating to maintenance and/or its management, with the aim of achieving continual improvement in performance. It is not intended to be used as the basis for penalizing contractors or service providers, but instead to encourage better performance. Requirements for performance management should be formulated as part of the maintenance strategy and policy and communicated to all affected stakeholders.

An organization should establish a performance management system based upon service level agreements. Where a quality management system exists, the relationship between that and the performance management system should be made clear. In such cases, information and data should be capable of being entered once into either system and should be accessible from both.

5.2 Quality Control

Quality of construction has to be ensured during planning stage and construction stage of the facility as already emphasized by making suitable provisions for use of durable materials, proper specifications, adequate detailing with emphasis on works required to be done after construction for maintenance and upkeep. All maintenance should ideally be inspected while it is being undertaken and immediately after completion to ensure that it complies with requirements. Records and accounts rendered for maintenance work carried out should be checked for completeness and accuracy.

5.3 Inspections

Maintenance is intended to ensure that the facility remains fit for purpose in terms of satisfying organizational goals. This requirement is met, in part, through an effective inspection regime and forward-looking maintenance reporting.

5.3.1 The facility should be inspected to determine the quality of the internal environment and the condition and performance of the structure, fabric, engineering installations, fixtures and finishes. Inspection intervals should take into account the properties and anticipated service life of elements/sub-elements.

Regular inspections are actual part of the procedures for the maintenance of buildings. They are needed for a variety of purposes and each purpose requires a different approach, if it is to be handled with maximum economy and efficiency. A more detailed inspection

covering all parts of a building is needed to determine what work should be included in cyclic and planned maintenance programme.

Inspections should be carried out carefully as unrecorded dangers may exist. If any area or task is suspected of being hazardous, suitable precautions should be taken.

5.3.2 Frequency of Inspection

Inspection should be carried out at the following frequencies:

- a) *Routine* — Continuous regular observations should be undertaken by the building user as part of the occupancy of building. Feedback resulting from this type of observation should be encouraged. Consultation with occupants and other users of the facility to determine the existence of any maintenance matters that may require action and, where such work has been undertaken, measurement of users' satisfaction with the outcomes.
- b) *General* — Visual inspections of main elements should be made annually under the supervision of suitably qualified personnel at appropriate times. That informs an organization's budgets for maintenance programmes and other maintenance.
- c) *Detailed* — The frequency of full inspection of the building fabric by suitably qualified personnel should not normally exceed a 5 year period. An inspection should be carried out by using a checklist made up of facility elements/sub-elements and arranged in a way that supports safe working.

5.3.3 Inspection Schedule

The preparation of a specific schedule should be encouraged. Once prepared, it can be used for subsequent inspections.

5.3.4 Inspection of Engineering Services

Engineering services generally have a shorter life expectancy than building fabric and because of their dynamic function; they should be subjected to more frequent inspections and maintenance.

Inspection of services should be carried out for three purposes as follows:

- a) To check, if maintenance work is required;
- b) To check, if maintenance work is being adequately carried out; and
- c) For safety reasons to comply with statutory requirements and if required, with recommendations of other relevant organizations.

The frequency of inspections for purpose (a) will depend upon types of plant and system manufacturer's recommendations and subjective judgment.

Frequencies for purpose (b) should be carried out on an annual basis.

5.3.5 Method of Inspection

The limited life of building services means it is important to record their residual life so that their replacement can be budgeted for, and inspection methods should be arranged accordingly.

A checklist of items of plant to be inspected should be considered. Detailed procedure of how inspections should be carried out is necessary because a simple visual inspection is unlikely to show whether plant is operating correctly and efficiently.

Inspections frequently necessitate the use of appropriate instruments by competent persons. An example of this is the inspections carried out to check compliance with statutory requirements.

When instruments are used, it is important that adequate training is provided in the use of instruments and interpretation of the results.

5.3.6 Records of all inspections should be maintained. Inspection report for buildings may be prepared in the format as given in Annex B.

5.3.7 Reporting

A maintenance report should be prepared. Information gained from inspections should be collated into two groups:

- a) The degree of urgency needed to carry out repairs; and
- b) A comparison of maintenance plans, including work of a planned preventive nature.

Attention should be paid to the requirements defined in the maintenance policy. Each item should be carefully assessed when postponing apparently non-urgent work so that it does not result in a major defect or failure over the longer term. The anticipated life of the facility, or any element of it, should be taken into account.

Anticipated failures and defects expected to lead to failure should be highlighted in reports. The resulting information should be arranged in three categories: those matters requiring immediate attention; those that can be placed into a maintenance programme; and those which can be postponed but which should continue to be monitored and reviewed.

The maintenance report should address all maintenance requirements not covered by planned preventive maintenance for a period of five to ten years. Where contracts run over longer periods, maintenance plans may extend beyond this limit. The following points should be included, as a minimum, in the maintenance report:

- a) Location;
- b) Name of element (for example, roof);

- c) Name of sub-element (for example, roof covering – tiling);
- d) Existing condition (for example, excellent, satisfactory, adequate, poor or unsafe);
- e) Prioritization of the element (for example, the redecoration of a customer-facing reception area will have a higher ranking than a storage room);
- f) Anticipated phasing of maintenance; and
- g) Cost of maintenance.

5.4 Standard Norms for Maintenance Management

5.4.1 Labour Management

Shall be as per the provisions given in IS 15183 (Part 3).

5.4.2 Recommendatory Expenditures for Maintenance

Shall be as per the provisions given in IS 15183 (Part 2).

5.5 Responsibility of Occupants for Maintenance of Facilities

The responsibility of occupants with respect to maintenance of facilities shall cover the following:

- a) Exterior property areas (including vacant land/structure, sanitation, sidewalk, weeds, exhaust vents, accessory structures).
- b) Exterior and interior structures (protective treatment, interior surfaces, structural members, roofs and their drainage).
- c) Rubbish and garbage (relating to accumulation and disposal of rubbish or garbage; containers).
- d) Pest elimination (infestation, responsibility – single owner or multiple occupancy).

For more details regarding responsibility, the provisions given in **9.12** of SP 7 (Part 12) : 2016 'National Building Code of India 2016: Part 12 Asset and facility Management' shall be referred.

5.6 Common Area Maintenance

Maintenance of common areas in any building, group of buildings, should be the responsibility of all those who share and use the common areas.

5.6.1 Common Areas and Equipment

The common area of a building or project includes all space contained in building premises that are not exclusive to any specific occupant(s) and which benefits, or is intended to benefit, all users/occupiers of the building, in common and without distinction.

Common area of a multiple building campus/project is proportionately loaded on to the individual segments within the overall campus. Common area of such campuses will include driveways, ramps, walkways, pavements, corridors, entrances, vestibules, stairways,

atriums, refuge area, terraces (with or without common rights of access) landscapes, common toilets, loading and unloading docks, dedicated property management office, parking areas, external peripheries, façade and elevation elements and utility areas such as DG room, plant room, etc.

Common equipment will include all types of pumps for water supply, firefighting, etc; lifts and escalators; firefighting system; heating, ventilation, and air conditioning (HVAC) plant and equipment; E and M equipment like electric panels, DG sets, transformers, lightning protection system, earthing system, etc.

5.6.2 Maintenance of Common Areas

One way to arrange for funds to carry out this function is to levy a common area maintenance (CAM) charge on all the users. The value of CAM to be charged can be decided by the owner or it can be collectively decided by the users. Normally, CAM is charged on pro-rate basis, that is, on the ratio of area in actual occupation of each user *vis-a-vis* the total area. While computing the CAM charges it is normal practice to include expense incurred towards providing common facilities to all occupiers of a building/facility like cost of housekeeping services; energy consumption of fixtures and equipment provided for the common areas; annual maintenance contracts, if any of equipment, spares and consumables; and charges for property management services, all expenses towards maintaining regulatory and statutory compliance as applicable to the building or the project; insurance of building and equipment; sinking fund and expenditure incurred on annual maintenance of common areas, etc.

5.7 Maintenance from Accessibility Consideration

All maintenance and refurbishment in public buildings and built environment shall take into account improving accessibility for persons with disabilities and care taken that accessible design features are properly maintained during maintenance activities [see B-25 of SP 7 (Part 3): 2016 'National building code of India 2016: Part 3 Development control rules and general building requirements' for more details]. Periodic access audits shall be carried out at least once in three years to ensure that the requisite accessible features as per SP 7 (Part 3), are provided in the building and its built environment and maintained in good condition on an ongoing basis.

6 BUILDING FABRIC MAINTENANCE

6.1 This constitutes maintenance of elements and components of a building other than furniture and services installations.

6.2 Prevention of Cracks, Repairs, Retrofitting and Seismic Strengthening of Buildings

Cracks in buildings are of common occurrence. A building component develops cracks whenever

stress in the component exceeds its strength. Stress in a building component can be caused by externally applied forces, such as dead, imposed, wind or seismic loads, or foundation settlement or it can be induced internally due to thermal movements, moisture, chemical action, etc. The buildings affected by earthquake may suffer both non-structural and structural damages. Non-structural repairs may cover the damages to civil and electrical items including the services in the building. Repairs to non-structural components need to be taken up after the structural repairs are carried out. Care should be taken about the connection details of architectural components to the main structural components to ensure their stability. The main purpose of the seismic strengthening is to upgrade the seismic resistance of a damaged building while repairing so that it becomes safer under future earthquake occurrences.

6.2.1 Prevention of cracks, repair work, seismic strengthening and retrofitting of an existing building shall be done in accordance with SP 7 (Part 7) : 2016 'National building code of India 2016: Part 7 Construction management, practices and safety'.

6.3 While demolishing a damaged building or existing unsafe building, safety precautions as given in SP 7 (Part 7) : 2016 'National building code of India 2016: Part 7 Construction management, practices and safety' shall be observed.

6.4 Depending on the size and complexity of a building premise or a structure, maintenance of the following related systems and installations may be required, as applicable:

- a) Maintenance of plumbing and drainage systems;
- b) Maintenance of heating, ventilation and air conditioning (HVAC) system;
- c) Maintenance of electrical installations;
- d) Operation and maintenance of lifts and escalators;
- e) Maintenance of firefighting systems;
- f) Roads and pathways management and upkeep;
- g) Health and safety requirements;
- h) Maintenance of landscaping and horticulture works;
- j) Housekeeping;
- k) Pest and rodent control;
- m) Security services for building occupants and assets; and
- n) Solid waste management;

For detailed provisions related to maintenance aspects of the above, the provisions in 11 to 22 of SP 7 (Part 12) : 2016 'National building code of India 2016: Part 12 Asset and facility management' may be referred.

7 INFORMATION MANAGEMENT

7.1 General

Records and documents relating to the maintenance of the facility should be organized, kept up-to-date and stored in a secure environment.

The following general information should be recorded:

- a) *Classification* — The facility and its sub-divisions (that is, rooms and other spaces) should be assigned codes according to type or use to support the management of information and data;
- b) Obligations under conditions of lease or occupancy (for example, frequency of repainting);
- c) Statutory and insurance inspections;
- d) Estate terrier (records of property holdings with legal status);
- e) Ownership of and/or maintenance obligations of parties, separating and boundary walls;
- f) Rights of way, easements and way-leaves (particularly with respect to buried utilities); and
- g) Requirements and restrictions laid down by planning, building regulation control and fire authorities including, in the case of the latter, fire risk assessments.

Elements/sub-elements of the facility should be labelled or marked, as far as is practicable, so that the materials, components, systems, plant, equipment and parts can be easily identified. Where information is limited or lacking, records should be compiled during maintenance. Alternative (or additional) surveys or investigations should be initiated to accelerate the gathering of information for record purposes; photographic records can be of assistance in this respect.

All personnel involved in the maintenance of the asset/facility should be made aware of the existence of records containing information about it. Hazardous areas should be explicitly marked on the records as well as marked in their physical location/site and should be made known to personnel, together with any system of work adopted for use in these areas.

7.2 Documentation

Good records can save owners and users/occupiers from much unnecessary expense and reduce potential hazards in exploration work, when faults arise. Records are of value only if they are kept up-to-date and arrangements for this should be included in any provision that may be made for records.

Records may be broadly classified as follows:

- a) 'As built' information, which should have been prepared before the handover of the facility, such as construction details, floor plans, perspectives and as-built drawings showing the location of

engineering installations, utility services, and structural details; and

- b) 'As subsequently altered', which need to be kept during the operational life of the facility, such as details of defects, maintenance, alterations and redecoration work.

A record should be kept of all reported defects and the measures taken to rectify them. Details of maintenance should also be recorded and cross-referenced to the reported defect.

Periodic reviews of records should be made and where there are recurrences of the same defect, the causes should be investigated.

7.2.1 Facility Handbook

A facility handbook should be prepared as a compilation of records of the asset/ facility, which can be stored and retrieved electronically, as well as being reproduced on paper, wherever necessary. The form of the handbook should be such that content can be easily updated and future versions of it to be controlled. The handbook should include the records relating to the maintenance of the facility and the documents to support the wider needs of the organization in regard to its facilities management.

Following should be typical contents of the facility handbook:

- a) A brief history of property, names and addresses of consultants and contractors.
- b) Short specifications, constructional processes, components, material finishes, hidden features, special features, etc.
- c) 'As built' plans and as subsequently altered with sections, elevations and other detailed drawings.
- d) Foundation and structural plans/sections such as concrete reinforcement drawings.
- e) Detailed specification of all materials incorporated, for example, concrete mix, species and grades of timber, etc. Potentially hazardous materials and types or methods of construction that under some circumstances may become hazardous may be identified.
- f) Information on housekeeping and routine maintenance with details of internal and external surfaces and decorations, schedule of cleaning, inspection and maintenance.
- g) Information on accessibility features of the building that makes it friendly to users with disabilities and elders.
- h) Means of operating mechanical, electrical and plumbing installations.
- j) Description of renovations, extensions, adaptations and repair to each element.
- k) All plant, machinery and proprietary articles

- including manufacturers trade literature and instructions for installation, use and maintenance.
- m) Methods of work used in construction such as assembly of prefabricated units.
 - n) All information related to fire such as:
 - 1) location and service arrangements of all fire alarm and call points;
 - 2) location and service arrangements of all extinguishers, hose reels and other firefighting installations;
 - 3) location of all fire compartment walls, doors, floors and screens;
 - 4) location of all areas of exceptional fire hazard;
 - 5) fire escape routes and assembly points in case of fire;
 - 6) details of application of any fire protection treatment; and
 - 7) location details and description of any installation for smoke control or protection of escape routes.
 - p) There should be a wall chart showing at a glance the various operations which have to be undertaken. Line drawings of buildings are always useful.
 - q) Records of security measures should be known to authorized personnel only.
 - r) Where no records exist, information should be slowly built up as it becomes available during the course of maintenance work.
 - s) Use of computers for storing information is preferred.

7.2.1.1 Drawings

The records of the facility should include as-built and as subsequently altered drawings [see 7.2.1 (c)] and contain, as a minimum, the following:

- a) A neighbourhood plan, showing the position of the facility and the site upon which it is located in relation to its surroundings;
- b) The site plan, showing the facility and other structures forming the facility and external engineering installations, for example drainage runs and incoming public utilities;
- c) General arrangement plans of each floor and the roof to a scale not normally greater than 1 : 50;
- d) Elevations and sections;
- e) Foundation plans and details, together with available soil investigation reports;
- f) Structural plans and sections, including information relating to design parameters, such as permissible superimposed loadings on floors;
- g) Structural details such as structural steel connections, concrete reinforcement drawings

and bending schedules. These are particularly important when pre-stressed or post tensioned forms of structure are used;

- h) Details of the construction of external wall elements and roofs, including insulation materials and vapour barriers;
- j) Materials that may be injurious to health and safety;
- k) Location of public health (that is, waste) systems;
- m) Location of essential intake and shut-off of public utilities (water, electricity, gas and telecommunications); and
- n) All drawings, including those used in design and construction, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected drawing(s) should be labelled as subsequently altered.

7.2.1.2 Specifications and schedules

The records of the facility should include detailed specifications of,

- a) all materials incorporated, for example name of facing brick, mix of concrete, diameter and spacing of reinforcement bars, species and grade of timber;
- b) materials with properties that can prove injurious to health and safety;
- c) all plant and machinery, including manufacturers' trade literature, manuals and instructions for installation, operation and maintenance; and
- d) methods of work used during construction, which are unusual or atypical, such as assembly of purpose-made manufactured units.

All specifications and schedules, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected specification(s) and/or schedule(s) should be labelled as subsequently altered.

7.2.2 Asset Register

Asset register is an important document and shall be maintained for each asset and kept updated. Many organizations maintain this as building register for keeping records of their assets and any modifications/alterations done during life time of the asset/facility. An organization should include other information and data as may be necessary in the form of a register of its assets/facility, for example:

- 1) Identification number or unique reference for the asset;
- 2) Location of asset;
- 3) Initial cost;

- 4) Completion cost (component /unit wise, if so required);
 - 5) Make and/or model;
 - 6) Manufacturer for machineries and equipment;
 - 7) Vendor, if different to manufacturer;
 - 8) Date of manufacture or year of construction for buildings;
 - 9) Date of acquisition, installation or completion of construction;
 - 10) Details of asset such as area statements, type of structure;
 - 11) Whether or not the asset is subject to a permit-to-work requirement;
 - 12) Predicted lifetime;
 - 13) Specifications including design considerations;
 - 14) Replacement cycle;
 - 15) Cost breakdown;
 - 16) Servicing requirements, including type and frequency of service;
 - 17) Other maintenance required;
 - 18) Maintenance costs;
 - 19) Accumulated depreciation;
 - 20) Written-down value;
 - 21) Source of components and spare parts, where applicable;
 - 22) Energy consumption and, where applicable, energy efficiency rating; and
 - 23) Identification of hazardous or other risks to people or property.
- be recorded against the respective item. A list of spare parts should be kept up-to-date. Details should include the following as a minimum:
- a) Description of part;
 - b) Identification number or unique reference for the part;
 - c) Original manufacturer of part;
 - d) Contact details of current manufacturer and/or distributor;
 - e) Predicted lifetime of part;
 - f) Operational parameters affecting lifetime of part;
 - g) Minimum number of parts to be held in stock (within or near to the facility);
 - h) Where permissible, details of any alternative part and its source;
 - j) Availability and minimum delivery period;
 - k) Warranty period;
 - m) Estimated cost of part;
 - n) Transportation and logistical considerations;
 - p) Details of other parts potentially affected by failure and/or replacement;
 - q) Specialist equipment or tools required;
 - r) Specific competence required; and
 - s) Details of special conditions or arrangements when installing.
- The details given in (a) to (s) are, in effect, an inventory that should be kept up-to-date if the organization is to minimize disruption and/or loss of business continuity in the event of a breakdown or failure. An organization should determine its policy on the holding of spare parts.

7.2.2.1 Engineering installations

Information describing the facility's engineering installations should be recorded. Details should include points of entry, or termination, of public utilities.

An organization should stipulate the maintenance requirements for its mechanical and electrical installations and fire protection systems; the tasks to be carried out and their frequency should be included. The following attributes of major components should be taken into account:

- a) Current condition;
- b) Current utilization or output;
- c) Maintenance tasks to be performed;
- d) Frequency of maintenance; and
- e) Estimated cost of maintenance.

7.2.2.1.1 Warranties, repairs and spare parts

Details of warranties relating to plant, equipment, components and systems should be recorded and cross-referenced to those operational and maintenance requirements that affect them. Details of repairs should

7.2.2.1.2 Documentation of mechanical records

Documentation should record the following as installed:

- a) Location, including level if buried, of all public service connections (for example, fuel gas and cold water supplies) together with the points of origin and termination, size and materials of pipes, line pressure and other relevant information;
- b) Layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes as well as the results of all balancing, testing and commissioning data;
- c) Location, identity, size and details of all apparatus and all control equipment served by, or associated with, each of the various services together with copies of any test certificates for such apparatus where appropriate. The information with respect to size and details may be presented in the schedule form;
- d) Layout, location and extent of all air ducts showing dampers and other equipment, acoustic silencers,

grilles, diffusers or other terminal components. Each duct and each terminal component should be marked with its size, the air quantity flowing and other balancing data; and

- e) Location and identity of each room or space housing plant, machinery or apparatus.

7.2.2.1.3 Drawings for mechanical installations

Drawings should record the following as installed:

- a) Detailed general arrangements of boiler houses, machinery spaces, air handling plant, tank rooms and other plant or apparatus, including the location, identity, size and rating of each apparatus. The information with respect to the size and rating can be presented in scheduled form;
- b) Isometric or diagrammatic views of boiler houses, plant rooms, tank rooms and similar machinery, including valve identification charts. It is useful to frame and mount a copy of such drawings on the wall of the appropriate room; and
- c) Comprehensive diagrams that show power wiring and control wiring and/or pneumatic or other control piping including size, type or conductor or piping used and identifying the terminal points of each.

7.2.2.1.4 Electrical installations

Records should be kept of the following as installed:

- a) Main and sub-main cables, showing origin, route, termination, size and type of each cable. Cables providing supplies to specialist equipment, for example data centre equipment, should be identified separately including their individual tagging, if available;
- b) Lighting conduits and final sub-circuit cables, showing origin, route, termination and size of each, together with the number and size of cables within each conduit. The drawings should indicate, for each conduit or cable, whether it is run on the surface or concealed, for example in a wall chase, in a floor screed, cast *in-situ* or above a false ceiling. These drawings should also indicate the locations of lighting fittings, distribution boards, switches, draw-in-boxes and point boxes, and should indicate circuitry;
- c) Details of secondary power sources for inclusion in a safe systems of work regime;
- d) Location and purpose of each emergency lighting fitting, including an indication of the circuit to which it is connected;
- e) Single and three-phase power conduits and final sub-circuit cables showing locations of power distribution boards, motors, isolators, starters, remote control units, socket outlets and other associated equipment;

- f) Other miscellaneous equipment, conduits and cables;
- g) Lightning conductor air terminals, conductors, earth electrodes and test clamps;
- h) Location of earth tapes, earth electrodes and test points; and
- j) Cables providing earth circuits for specialist equipment should be identified separately.

Records should also include, where applicable:

- 1) Distribution diagrams or schedules to show size, type and length (to within 1 m) of each main and sub-main cable, together with the measured earth continuity resistance of each;
- 2) Schedule of lighting fittings installed stating location, manufacturer and type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed;
- 3) Schedule of escape and emergency lighting fittings installed stating location, manufacturer, type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed. For battery systems, the position of the battery, its ampere-hour rating and battery system rated endurance, in h, should be stated;
- 4) Records of smoke detectors, sprinklers and fire precautions generally, as well as security precautions;
- 5) Incoming supply details including the type of system, voltage, phases, frequency, rated current and short circuit level, with the details of the supply protection and time of operation as appropriate;
- 6) Main switchgear details which, for purpose-made equipment, should include a set of manufacturers' drawings and the site layout;
- 7) Transformer, capacitor and power plant details. For example in the case of transformers, the volt-ampere rating, voltages and type of cooling; and
- 8) Completion certificate including test reports by competent authority like electrical inspector.

All records and drawings, including those used during construction work, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected record(s) and/or drawing(s) should be labelled as subsequently altered.

7.2.3 Operating and Maintenance Manuals

7.2.3.1 The engineering services within buildings frequently are dynamic, involving complex systems of integrated plant items. Operation of such plant can require detailed knowledge and direction. Maintenance can also require extensive information to be available. It is, therefore, important to have suitable operating and maintenance manuals to provide the necessary

guidance. These should be included as part of the contractual requirements for new installations and should ideally be prepared as reference documents for existing installations where no such information exists.

7.2.3.2 Information and data on the operation and maintenance of the facility, including measures to conserve fuel and power, should be incorporated into the operation and maintenance (O and M) manual. The organization should ensure that provisions made in the facility handbook are satisfied.

Preparation of an O and M manual tailored to suit each facility can offer significant advantages in terms of providing a clear statement of intentions and required actions. Depending upon whether one is responsible for the maintenance of a number of facilities or a single facility, the maintenance manual will be designed and prepared.

An organization's procedures for undertaking maintenance should be formalized in a maintenance manual or manuals. The manual may form part of wider documentation covering operational plans and arrangements. In the event of a change of organization or maintenance advisor, an up-to-date manual and facility handbook should ensure continuity of maintenance. Copies of maintenance manuals should be held by the organization and any maintenance advisor, if appointed.

7.2.3.3 *Structure of operation and maintenance manual*

The maintenance manual should be prepared in two parts:

- a) The first part should be addressed to the organization; and
- b) The second part should be addressed to those responsible for inspecting the facility and reporting to and advising the organization.

The first part of the manual should,

- 1) Recommend intervals between:
 - i) routine, general and detailed inspections;
 - ii) inspection and maintenance of each engineering installation and items of special equipment;
 - iii) maintenance of items which, as recommended by their manufacturers, require regular attention to preserve satisfactory performance, for example the lubrication and adjustment of moving parts in component assemblies and systems; and
 - iv) other periodic work as experience in use shows to be necessary, for example humidity ingress in vertical direction from floors above, the clearing of gutters, downpipes or surface water gullies.
- 2) Draw attention to the need to ensure that a facility's provisions for means of escape in the event of fire, that is, fire resisting self-closing

doors and exit hatches, are in satisfactory working order at all times, including those periods during which any maintenance is being undertaken.

- 3) Draw attention to critical environments, including special arrangements for gaining access for the purpose of inspections or when undertaking maintenance;
- 4) Specify proprietary maintenance materials, for example floor sealers and polishes likely to offer acceptable service and slip resistance; sanitary fittings, door/window sections, etc.
- 5) Set out the names, addresses and other contact details of firms responsible for the following:
 - i) inspecting, reporting and advising on the condition of the building fabric;
 - ii) emergency repairs to the building fabric; and
 - iii) servicing and emergency repairs for each engineering installation and items of special equipment.

The second part of the manual should:

- a) consist mainly of selected, concise information, abstracted from the facility handbook, and likely to be needed during inspections; this information should be ordered in the sequence in which examination is likely to be carried out.
- b) schedule those materials and components that experience shows to be prone to failure and/or to require special attention.

7.2.3.4 *Updating of O and M manual*

The maintenance manual should be reviewed annually and updated where necessary, to reflect changes in legislation as well as current circumstances and arrangements. When changes occur to facilities, or where new information becomes available, all copies of the maintenance manual should be revised accordingly, irrespective of whether it is self-standing or forms an integral part of the facility handbook.

7.3 *Storage and Security of Records*

7.3.1 *General*

An organization should keep records in a safe and secure location and arrange them in such a way as to enable their rapid retrieval. Records of personnel permitted to access the records and any requirements or conditions attaching there to should be defined.

7.3.2 *Storage*

The place for storage of records should take into account the form of the records, the media used and the conditions necessary to keep them from damage of any kind; they should also be readily accessible. Backup or duplicate records (electronic and paper-based) should

be kept in a secure place in a location other than the facility to which they relate. Both sets should be kept up-to-date.

7.3.3 Security

Measures taken to ensure security should be recorded and a copy should be held in a secure location away from the facility to which they relate. The following records should be readily accessible to authorized personnel when required, which may be at short notice and outside normal working hours:

- a) Names, home addresses and telephone numbers of key holders;
- b) Details of master key system; and
- c) Details of intruder alarms and other security systems.

7.4 Computerization of Information Management

An organization should review its requirements for data systems, basic information and communication technology (ICT) facilities and extended services necessary to support its maintenance management. The use of a Computer-Aided Facilities Management (CAFM) or a Computerized Maintenance Management System (CMMS) as means for managing facility related maintenance information should be evaluated. The following features are likely to provide a suitable basis:

- 1) Budgetary and other financial controls;
- 2) Cost accounting;
- 3) Asset register;

- 4) Condition-based monitoring of assets;
- 5) Early detection of problems and rapid fault reporting;
- 6) Operational plans, including frequency of functions or activities performed;
- 7) Risk and hazard assessment;
- 8) Permits-to-work;
- 9) Personal protective equipment issued and returned;
- 10) Planned preventive maintenance;
- 11) Reactive maintenance;
- 12) Change management;
- 13) Job orders and other requisitions for goods and services;
- 14) Job logging, prioritization and tracking, including details of backlogs;
- 15) Energy use and carbon dioxide (CO₂) equivalent emitted per annum;
- 16) Resource consumption and productivity measures;
- 17) Analysis of work undertaken to identify trends;
- 18) Space planning and space utilization;
- 19) Workstation location and furniture management;
- 20) Performance indicators for the delivery of services;
- 21) End-user experiences of services delivered;
- 22) Audit trail of system transactions; and
- 23) Exception reporting for management purposes.

ANNEX A

(Clause 4.4.3)

COMMON CAUSES FOR MAINTENANCE PROBLEMS

A-1 The major causes for maintenance problems in different elements of a building are discussed in **A-1.1** to **A-1.5**.

A-1.1 Floors

- a) Poor quality of construction which includes quality of construction material and workmanship.
- b) Improper slopes, mainly in kitchen, bathrooms/toilets, etc.
- c) Lack of rounding at junctions of walls with floors.
- d) Lack of damp-proof course treatment in walls and particularly in sunken floors.
- e) Poor design of building.
- f) Improper waterproofing.

A-1.2 Roofs

- a) Inadequate roof slopes.
- b) Inferior quality of construction.
- c) Cracks on roof surfaces.
- d) Inadequate provision of rain water spouts.
- e) Blockages in gratings/rain water pipes.
- f) Worn out felts/membranes.
- g) Bubbling up of bitumen felt and separation of joints.
- h) Improper water proofing or wrong selection of water proofing technique.
- j) Leakage from the openings provided on the roof.
- k) Improper treatment of expansion/construction joints.
- m) Non-providing of *Gola* (rounding) at junction of parapet and wall and roof.
- n) Improper execution of *Khurra*.

- p) Lack of pre-monsoon inspections.
- q) Illegal installations over roof slab.

A-1.3 Plumbing

- a) Inadequate slopes in soil/waste pipes.
- b) Improper joints in pipes.
- c) Joints in walls and floors.
- d) Improper junctions of stacks.
- e) Inadequate cleaning eyes at junctions.
- f) Throwing of solid wastes in WCs.
- g) Lack of periodical checking and cleaning.
- j) Lack of motivation/education to users for proper use.
- k) Overflow from service tanks.
- m) Inferior quality of fittings and fixtures.
- n) Inadequate design.

A-1.4 Drainage

- a) Improper surface dressing around buildings and improper upkeep of surroundings.
- b) Growth of wild grass and vegetation.
- c) Inadequate drainage system around the building.
- d) Inadequate slope of the drains or drainage pipes.
- e) Inadequate number of inspection chambers.
- f) Theft of manhole covers, etc.
- g) Throwing of solid waste in the open surface rains.

A-1.5 Electrical

- a) Loose connections.
- b) Improper earthing and earth connections.
- c) Damages to wires, cables and other installations.
- d) Under rated cables/wires and other installations.

ANNEX B

(Clause 5.3.6)

FORMAT FOR INSPECTION REPORT

Building/Block:

(A) INSPECTION OF BUILDINGS (CIVIL)									
(a) House No. and Type:					(b) Location:				
(c) Date of Last Inspection:					(d) Date of Present Inspection:				
Sl No.	Item No.	Needs Repair			Needs Replacement		Priority		
		Action	Quantity	Cost	Quantity	Cost	Immediate	Annual	Routine Repairs
1.	Walls								
1.1	Cracks								
1.2	Repair to plaster								
1.3	Repair to brick work								
1.4	Dampness								
2.	Floors								
2.1	Cracks								
2.2	Settlement								
2.3	Slopes								
2.4	Skirting cracks								
2.5	Dados cracks								
2.6	Rising dampness								
3.	Doors, Windows, Ventilators and Cupboards								
3.1	Glass panes cracked or broken								
3.2	Panels in shutters cracked or broken								
3.3	Panels fit improperly								
3.4	Improper/missing fittings								
	3.4.1 Hinges								
	3.4.2 Handles								
	3.4.3 Tower bolts								
	3.4.4 Aldrops								
	3.4.5 Floor door stopper								
	3.4.6 Knobs								
	3.4.7 Cleats								
	3.4.8 Hooks and eyes								
	3.4.9 Curtain rods								
	3.4.10 Stays								
	3.4.11 Pelmet								
	3.4.12 Floor springs								
	3.4.13 Door closures								

(A) INSPECTION OF BUILDINGS (CIVIL)									
(a) House No. and Type:					(b) Location:				
(c) Date of Last Inspection:					(d) Date of Present Inspection:				
Sl No.	Item No.	Needs Repair			Needs Replacement		Priority		
		Action	Quantity	Cost	Quantity	Cost	Immediate	Annual	Routine Repairs
4.	Roofs								
4.1	Leakages/damp patches								
4.2	Water proofing treatment								
4.3	<i>Gola</i> (rounding)								
4.4	<i>Khurra</i> (mouth/ inlet of rainwater pipe on the roof)								
4.5	Brick drip course								
4.6	Rain water pipe								
4.7	Regrading								
4.8	Top layer of tiles								
4.9	Parapet, coping								
5.	Water Supply and Sanitary Fittings								
5.1	Leakages in pipe joints								
5.2	Functioning of washers								
5.3	Functioning of traps in fittings								
5.4	Functioning of floor traps								
5.5	Functioning of overhead/ low level cistern								
5.6	Air locking								
5.7	Leakages in pipe joints								
5.8	Condition of overhead tank								
5.9	Cleaning of overhead tank								
5.10	Fittings								
	5.10.1 Washbasin								
	5.10.2 Soap container								
	5.10.3 Mirror								
	5.10.4 Glass shelf								
	5.10.5 Towel rail								
	5.10.6 Hangers								
	5.10.7 Sinks								
	5.10.8 Taps								
	5.10.9 Pillar cocks								
	5.10.10 Showers								
	5.10.11 Cisterns								
	5.10.12 Ball valves								
	5.10.13 Seat cover								
	5.10.14 Steps								
	5.10.15 European WC								

IS 15183 (Part 1) : 2018

(A) INSPECTION OF BUILDINGS (CIVIL)									
(a) House No. and Type:					(b) Location:				
(c) Date of Last Inspection:					(d) Date of Present Inspection:				
Sl No.	Item No.	Needs Repair			Needs Replacement		Priority		
		Action	Quantity	Cost	Quantity	Cost	Immediate	Annual	Routine Repairs
6.	External Services								
6.1	Manhole covers								
6.2	Covers to gully traps								
6.3	Cleaning of manholes								
6.4	Plinth protection								
6.5	Cleaning of storm water drain								
6.6	Approach roads								
6.7	Service lanes								
7.	Finishing								
7.1	White washing/colour washing/ distemper								
	(a) When was it done last?								
	(b) When is it due?								
	(c) Existing condition								
7.2	Painting								
	(a) When was it done last?								
	(b) Existing conditions								
	(c) When is it due?								
8.	Common Areas								
8.1	Railing to staircase								
8.2	Staircase steps								
8.3	Staircase nosing								
8.4	Shafts								

(B) INSPECTION OF BUILDINGS (ELECTRICAL)									
(a) House No. and Type:					(b) Location:				
(c) Date of Last Inspection:					(d) Date of Present Inspection:				
Sl No.	Item No.	Needs Repair			Needs Replacement		Priority		
		Action	Quantity	Cost	Quantity	Cost	Immediate	Annual	Routine Repairs
1.	Switch Boards								
1.1	Regulator								
1.2	Switches								
1.3	Fixing of tiles								
2.	Fans								
2.1	Canopy fixing								
2.2	Speed and noise								
3.	Socket outlet points and connection								
3.1	Tile								
3.2	Switch								
3.3	Outlet connection, if any								
4.	Fittings								
4.1	Reflector								
4.2	Louvres/Perspex cover								
4.3	Suspension rod								
5.	Exhaust Fans								
5.1	Speed and noise								
5.2	Louvres								
5.3	Connecting wires including ceiling rose								
6.	Call Bells								
6.1	Bell push								
6.2	Connecting wire								
6.3	Ball Buzzer								
7.	Sub Distribution Boards/ BDB/Main Board								
7.1	Switch covers								
7.2	Fuse kit kets								
7.3	Earth connection								
7.4	Fuse rating								
7.5	Inter connection								
7.6	Boards								

IS 15183 (Part 1) : 2018

(C) INSPECTION OF BUILDINGS/GARDENS									
(a) House No. and Type:					(b) Location:				
(c) Date of Last Inspection:					(d) Date of Present Inspection:				
Sl No.	Item No.	Needs Repair			Needs Replacement		Priority		
		Action	Quantity	Cost	Quantity	Cost	Immediate	Annual	Routine Repairs
1.	Lawn								
1.1	Weeding								
1.2	Patch repair								
1.3	Renovation								
1.4	Regrassing								
2.	Hedge:								
2.1	Gap filling								
2.2	Replacement								
3.	Pruning and Training								
3.1	Naturally required pruning								
3.2	Pruning required for security purpose of building as well as occupant								
4.	Planting Beds								
4.1	Needs Replacement								
4.2	Gap filling								
5.	Ultrafiltration Water Supply								
5.1	Matter to be reported to Ultrafiltration water division after inspection								
6.	Rockeries								
6.1	Gap filling of dead one								
6.2	Replacement of damaged, weak elements								
6.3	Replacement of stones								
6.4	Thinning, trimming								
6.5	Redesigning of paths, maintenance of paths								
7.	Kitchen Garden								
7.1	Change in site								
7.2	Plan for planting of vegetables								
8.	Road Side Plantation								
8.1	Gap filling Nos.								
8.2	Trimming, pruning								
8.3	Tree guards not required and to be removed/ repair/painting, etc.								
8.4	Proposal for new plantation, digging of holes, etc.								
8.5	Miscellaneous								
8.6	MOU- Detailed report (Performance and financial achievements)								

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

Building Construction Practices Sectional Committee, CED 13

<i>Organization</i>	<i>Representative(s)</i>
In Personal Capacity (<i>Flat No. 2061, Engineers Apartments, Plot 11, Sector - 18A, Dwarka, New Delhi 110078</i>)	SHRI D. S. SACHDEV (Chairman)
Ahluwalia Contracts (India) Limited, New Delhi	SHRI SHOBHIT UPPAL SHRI PRADEEP KUMAR (<i>Alternate</i>)
Association of Consulting Civil Engineers (India), Bengaluru	SHRI A. N. PRAKASH SHRI SATISH V. SALPEKAR (<i>Alternate</i>)
Bhabha Atomic Research Centre, Mumbai	SHRI K. SRINIVAS SHRI H. E. IYER (<i>Alternate</i>)
Builders Association of India, New Delhi	SHRI SUROJIT SAMANTA SHRI RAM AVTAR (<i>Alternate</i>)
Building Materials & Technology Promotion Council, New Delhi	SHRI CHANDI NATH JHA
Central Insecticides Board, Faridabad	ADDITIONAL PPA CUM SECRETARY (CIB & RC) JOINT DIRECTOR (ENTOMOLOGY) (<i>Alternate</i>)
Central Public Works Department, New Delhi	CHIEF ENGINEER (CSQ) SUPERINTENDING ENGINEER (TAS) (<i>Alternate</i>)
Confederation of Construction Products and Services, New Delhi	SHRI DEEPAK GAHLOWT SHRI SHASHI KANT (<i>Alternate</i>)
CSIR-Central Building Research Institute, Roorkee	SHRI S. K. NEGI DR AJAY CHOURASIA (<i>Alternate</i>)
CSIR-North East Institute of Science and Technology, Jorhat	REPRESENTATIVE
CSIR-Structural Engineering Research Centre, Chennai	DIRECTOR DR P. SRINIVASAN (<i>Alternate</i>)
Delhi Development Authority, New Delhi	CHIEF ENGINEER (SZ) SUPERINTENDING ENGINEER (P) -1 (<i>Alternate</i>)
Delhi Urban Shelter Improvement Board, New Delhi	REPRESENTATIVE
Engineers India Limited, New Delhi	SHRI RAJANJI SRIVASTAVA SHRI RAVINDRA KUMAR (<i>Alternate</i>)
Forest Research Institute, Dehradun	DR KISHAN KUMAR V. S
Housing & Urban Development Corporation Limited, New Delhi	REPRESENTATIVE
Indian Buildings Congress, New Delhi	SHRI S. C. BHATIA SHRI P. S. CHADHA (<i>Alternate</i>)
Indian Pest Control Association, New Delhi	VICE PRESIDENT GENERAL SECRETARY (<i>Alternate</i>)
Indian Plywood Industries Research & Training Institute, Bengaluru	SHRI AMITAVA SIL SHRI ANAND NANDANWAR (<i>Alternate</i>)
Larsen & Toubro Limited, ECC Division, Chennai	SHRI RAJAN VENKATESWARAN SHRI V. SUKUMAR HEBBAR (<i>Alternate</i>)

IS 15183 (Part 1) : 2018

<i>Organization</i>	<i>Representative(s)</i>
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	JT DG (ARCHITECTURE)
NBCC (India) Limited, New Delhi	EXECUTIVE DIRECTOR (ENGG) GENERAL MANAGER (ENGG) (<i>Alternate</i>)
NTPC Ltd, New Delhi	SHRI R. L. DAS SHRI ANIL KAPOOR (<i>Alternate</i>)
Pest Control (India) Pvt Ltd, Mumbai	SHRI SHANKAR M. GHUGE SHRI NITIN B. JAGTAP (<i>Alternate</i>)
Public Works Department, Govt of Gujarat, Gujarat	SUPERINTENDING ENGINEER, DESIGN (R & D)
Public Works Department, Govt of NCT of Delhi, New Delhi	REPRESENTATIVE
Research, Designs and Standards Organization, Ministry of Railways, Lucknow	DIRECTOR (WORKS) ADE (WORKS) (<i>Alternate</i>)
School of Planning & Architecture, New Delhi	PROF ANIL DEWAN PROF JAYA KUMAR (<i>Alternate</i>)
The All India Glass Manufacturers' Federation, New Delhi	SHRI SOURABH KANKAR SHRI RUPINDER SHELLY (<i>Alternate</i>)
The Energy and Resources Institute, New Delhi	SHRI SANJAY SETH MS MEGHA BEHAL (<i>Alternate</i>)
The Indian Institute of Architects, Mumbai	SHRI VIJAY GARG SHRI SHAMIT MANCHANDA (<i>Alternate</i>)
The Institution of Engineers (India), Kolkata	SHRI P. K. ADLAKHA SHRI DEVENDRA GILL (<i>Alternate</i>)
In personal capacity, (<i>Pratap Nursery Lane Near Gurudwara, Panditwari, Dehradun</i>)	SHRI K. S. PRUTHI
BIS Directorate General	SHRI SANJAY PANT, SCIENTIST 'F' AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

Member Secretary
SHRI S. ARUN KUMAR
SCIENTIST 'D' (CIVIL ENGINEERING), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 2016* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: CED 13 (12401).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

	Telephones
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	{ 2337 8499, 2337 8561 2337 8626, 2337 9120
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg CHANDIGARH 160019	{ 265 0206 265 0290
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 2254 1216, 2254 1442 2254 2519, 2254 2315
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 2832 9295, 2832 7858 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE.
DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI.
HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW.
NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi